American International University - Bangladesh

Thesis

Vehicle collision detection & prevention using VANET based IoT with V2V.

Thesis
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Declaration

We certify that this thesis is our original piece and that we have not submitted it in any way to any university or other higher education organization for another degree or qualification. This book contains a list of references and appreciates the use of information from others' journal articles work.

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Abstract

A change from planned or expected behavior or a sequence of events that endangers or negatively affects people, property, or the environment is defined as an emergency. On the other hand, it can be thought of as a midpoint between collision detection and prevention. This paper presents the results of a major analysis of collision (automobile) emergency alert conditions. In this study, the authors have investigated modern Internet of Things (IoT) and VANET (Vehicular Ad hoc Networks) technologies and developed a collection of modern and specialized techniques, as well as their characteristics. It has sensors that detect unbalanced vehicles and provide a warning to the microcontroller if a collision occurs. The technology has been designed in such a way that it would not only detect but also prevent a collision in any situation. Additionally, the technique can be implemented in such a way that vehicles are alerted of possible closing barriers. Vehicle-to-vehicle communication (V2V) has a huge impact since it allows vehicles to communicate with one another while in close proximity, and the buzzer, together with the LEDs, serves as a safety feature. The system's primary goal is to carry out the microcontroller functions in every environment, moreover the concept refers to detect and prevent the collision in a foggy weather and at night. Wireless technology, along with the Internet of Things (IoT), has resulted in a vast and significant expansion of VANETs infrastructure in recent years (Vehicular Ad hoc Networks). The Internet of Things (IoT) and the Vehicular Ad-Hoc Network (VANET) have now been merged as the fundamental and central components of today's Intelligent Transportation System (ITS). As a result, we'd like to create a system that notifies the driver when a situation is potentially dangerous and quickly shares that area in the event of a collision. If any type of collision occurs, the system will provide emergency assistance such as hospitals, police stations, and insurance companies. A message will be sent to the registered family member's phone number as well. Furthermore, while the procedure of obtaining the insurance may be longer for certain people, others may avoid the law after being involved in severe collisions, making it difficult for authorities to discriminate between criminal and non-criminal evidence.

Keywords: IoT, VANET, collision, sensors, microcontroller, V2V, foggy environment, nighttime.

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Chapter 1: Introduction

1.1 Background

Transportation is the act of moving people or products from one location to another in order to suit a user's observed social and economic demands. The transportation system evolves as these needs change, and challenges arise as it becomes harder to serve the public good. Collisions are one of the negative effects of any transportation system [27]. As a result, vehicle collisions have become a common occurrence among the general public. Every hour, 17 people die in Bangladesh, and every year, almost 1.5 lakh individuals die [13]. This proportion climbed to a new high in 2019. The rate of accidents is increasing every day as the number of vehicles on the road increases. Yearly, the death rate rises to 2.4 percent [13]. Approximately 80% of accidents lead to the demise of multiple people. Road accidents adversely impact developing countries on a regular schedule. The main reasons are inadequate infrastructure, traffic control, and accident management. South Asia, particularly India and Bangladesh, have been identified as the developing countries with the highest frequency of accidents [1]. However, given that we have technological superiority on our side and exist in a universe whereby newer technologies are being developed, we can use these approaches in our society to help each other fix issues. Currently, the Internet of Things (IoT) is a figurative concept picturing global Internet connectivity, transforming everyday objects into connected devices. The core idea behind the IoT concept is to spend billions, if not trillions, of smart devices capable of detecting any sort of collisions, general climate, sending and assessing obtained data, and then criticizing the climate. By the end of 2021, it is expected that there will be 28 billion connected devices [6]. IoT systems are a network that connects devices to collect and share data, and they are utilized in a variety of applications [2]. An ad hoc network for automobiles is a network of moving vehicles where each vehicle acts as a node in the creation of a mobile network. Every car or node functions as a wireless router or node, with a communication range of 100 to 300 meters between two vehicles, allowing for a wide range of VANET applications [24].

1.2 Problem statement

The advancement of automobiles is quite rapid, resulting in numerous accidents and risks as a result of traffic, foggy weather, night mode and what not. On the other side, the absence of rapid aid, which could have saved a human's life by a few seconds, is the most prevalent cause of death in an accident. It all depends on how swiftly they react, which might be the difference between life and death. [5]. Especially at night and in foggy weather, the ratio of accidents is severe because of the over speed of vehicles and heavy fog. So, it's high time we can apply such strategies related to driving safety for every circumstance in our system and help to manage such challenges because we live in a tech world that is constantly evolving with new technology. It's worth noting that, in recent years, technologies such as IoT and VANET have provided an advanced solution to this problem.

The number of deaths is increasing every week, month, and year. And, if the system continues to move in the same direction, this ratio will never decrease. The table below represents the general situation in terms of how dangerous our time is on the road. (Source: Bangladesh Police)

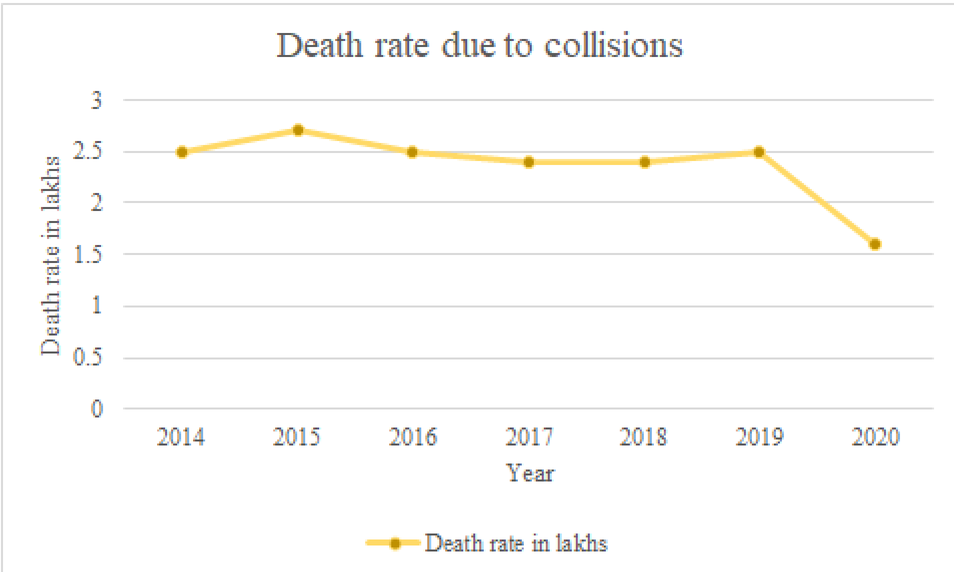


Figure 1: Total estimated number of deaths due to accidents from 2014 to 2020 [13]

It's not just about deaths; there is a slew of additional issues that wreak havoc on the general people. Almost 70% of the population is required to leave home almost every day of the year, either to study or to earn a living [23]. Traffic acts as a barrier in this process, and in the worst-case situation, it produces accidents, which result in deaths. Furthermore, because of the traffic, individuals who have been critically injured cannot be transported to the hospital in a timely manner. Aside from that, driver behavior is the biggest cause of traffic accidents. Though there are a variety of causes for automobile collisions, the majority of them are caused by the driver's inattention and excessive speed. Given the circumstances, it's past time to find a way out of this situation. [18].

1.3 Motivation

In Bangladesh, where an accident victim receives less attention, a device that can communicate with the nearest hospital and police station is required. Each year, more than 3,000 people are killed on Bangladesh's roadways, according to data. With more than 85 deaths per 10,000 registered motor vehicles, the country has one of the world's major causes of death. In most Western countries, this rate is roughly 50 times higher. Furthermore, due to vehicle over-speeding and severe fog, the ratio of accidents is especially high at night and in foggy weather. According to the World Health Organization, road traffic injuries cost Bangladesh roughly 2% of GDP, or £1.2 billion each year (WHO). This is the total amount of foreign aid received throughout the course of a fiscal year. Medical bills, insurance losses, property damage, lost family income, and traffic issues are among the losses. [13].

According to statistics, traffic is one of the most dangerous ways to cause an accident in any situation. Over the last five years, the rate has decreased in the tiniest of ways. Still, there is cause for concern, as the number of deaths relative to the number of accidents is not far apart. The graph below shows the number of individuals who have died in Bangladesh as a result of road traffic accidents in recent years.

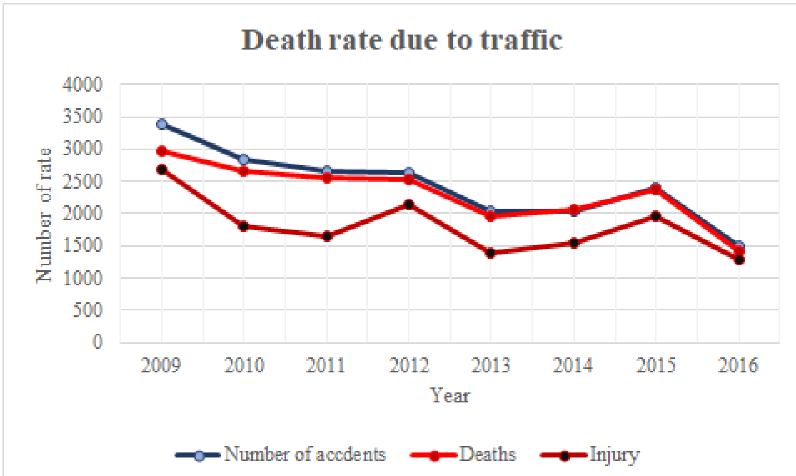


Figure 2: Death rate due to traffic. (Source: Bangladesh Police)

Fog has been an occasional tragedy in our country's recent history, causing fatal accidents. And, shockingly, the death ratio has remained steady in recent years. During the winter season in Bangladesh, the north is blanketed in dense fog. As a result, automobile collisions are fairly common because the driver can barely see what is going on around him. The death rate due to fog during the last ten years is depicted in the graph below.

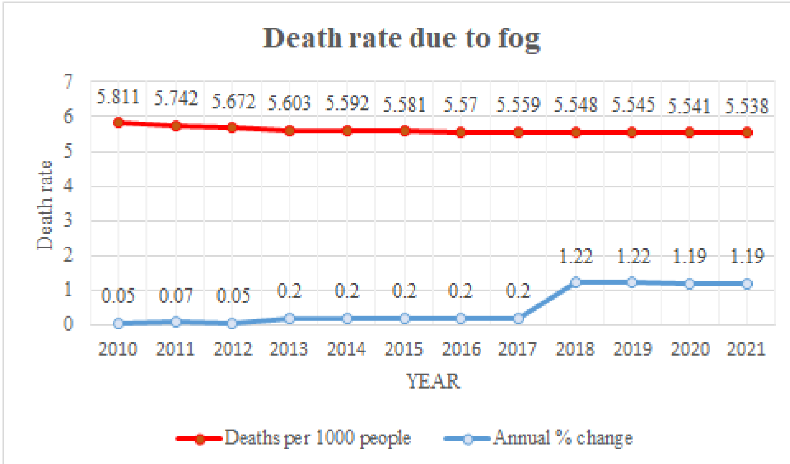


Figure 3: Death rate due to fog. (Source: https://www.macrotrends.net/countries/BGD)

1.4 Variety of Accidents

According to the facts, vehicle crashes are unquestionably one of the most concerning issues for everyone, and they require immediate and decisive action. As previously stated, over speeding, irresponsible behavior, reckless and unsafe driving are the most common causes of automobile collisions. The most common types of car accidents are depicted in the table below [38].

Type	Explanation
Rear-end collisions	When a driver suddenly slows down or uses the brakes, this type of collision occurs. The vehicle following the automobile crashed into it from behind as a result of the sudden change in speed, as the driver behind the car did not anticipate the car abruptly applying the brakes.
Side-impact accidents	This type of collision occurs when an automobile is struck from the side. Another vehicle could hit the car from the front or rear, or it could be hit by a fixed object.
Sideswipe collisions	When two cars driving parallel to each other collide while in motion, this type of collision occurs. When a car collides with a motorcycle, even if it is a minor incident, it can be fatal.
Vehicle rollover	A rollover accident occurs when a vehicle crashes with another vehicle or a stationary object. After a collision with something, any vehicle can roll over, although vehicles have a greater portion of rollovers than some other vehicles.
Head-on collisions	When two vehicles crash head-on, this is described as a head-on

	collision. Generally, the outcomes of such an accident are severe and devastating, and the victim's possibilities of survival are tiny.
Single-car accidents	When a vehicle meets up with a pole, a wall, or a tree, it is called a single-car accident. A vehicle hitting a person falls into this category and also.
Multivehicle collision	Multi-vehicle collisions are most common on congested roads or highways when cars are going at high speeds and in close quarters. Due to the general close vicinity of the vehicles, a significant number of vehicles could crash if one vehicle comes into contact with another. Many innocent persons are harmed in this type of occurrence because of one or two cars.
Hit-and-run accidents	A driver impacts someone or an animal and flees in this type of collision.

Table 1: Types of the accident [38]

Accidents are nightmares that strike a specific family in a tragic way, and only that person and their family members appreciate the need for a solution that can provide them with road safety services. With this goal in mind, this project will devise a framework that can identify accidents and notify a hospital, police station, and insurance company, as well as display the nearest hospital to vehicle drivers. As a result, the hospital and police station can mobilize rescue teams in a couple of minutes. In addition, many customers find the procedure of making an insurance claim to be time-consuming. People might sometimes escape the law after being involved in life-threatening accidents, making it difficult for investigators to identify the perpetrators. This program will contribute to addressing all of these issues by reducing the increased loss and damage caused by disasters.

Chapter 2: Related Work

2.1 Literature review:

The proposed IoT-based car accident detection and notification algorithm for general road accidents aim to create a system that allows hospitals and other emergency platforms to receive real-time updates on nearby incidents. That is, an IoT-based framework has been created to keep people up to date on incidents so that emergency medical help may be provided quickly. This can be achieved by utilizing smart sensors with a microprocessor within the vehicle that can be activated in the event of an accident [1].

Accident Detection, Alert, and Tracking System Based on IoT introduced an IoT-based system for rapid accident detection, alert, and tracking. The author has used some sensors in this proposed system, such as a vibrating sensor and an alcohol sensor. Alcohol sensors primarily determine whether or not the driver has consumed alcohol. If it detects alcohol, the data is communicated to the server, and the car will not start [2].

Simulation Of Accident Detection System Using VANET, the idea behind this proposal is to use VANET (Vehicular Ad-Hoc Network) simulation to detect the accident location via GPS, inform the nearest hospital via GSM, and finally, to clear the path on the way to the accident location, the client application on the ambulance generates alert messages [3].

Detection of Vehicle Collisions Using IoT, this paper proposes that the system collects data from surrounding automobiles. The use of this system in automobiles reduces the chances of an accident. Because of their low cost and efficiency, these systems are easily affordable. They describe the operation of collision avoidance systems using ARM microcontrollers, as well as the concept of the Internet of Things, in this study [6].

VANETs and the Internet of Things (IoT): A Discussion tries to explore and explain the main challenges and drawbacks that VANETs experiences, such as routing protocols, security, and privacy. VANETs (Vehicular Ad hoc Networks) is one of the approaches that is frequently utilized in the automobile sector to speed up communication between vehicles and roadside units (RSUs). VANETs are a sort of self-organizing network that belongs to the Mobile Ad hoc Networks category (MANETs). In order to cope with the new wireless technology period, The importance of IoT based on VANET in traffic control management systems is described in detail. [8]. Smart Vehicle Monitoring System using IoT, this project outlines the construction of an effective information system that can monitor the condition of an automobile, vehicle, or car while moving. This project aims to provide information regarding the location of automobiles, vehicle accidents that affect family members of travelers, and gas leakage from vehicles that causes accidents. This application uses an accelerometer sensor to detect vehicle unevenness and vibrations in the event of a collision. A signal is sent to the microcontroller as a consequence of this [9].

This project, Automatic Accident Detection and Reporting System is designed to alarm the driver when the automobile moves too close to the other vehicle by measuring the distance between the vehicles using an ultrasonic sensor, as well as to notify relevant parties of the accident location. If an accident is detected by sensors already in the airbag network, the ECU of current automobiles will send a high signal to the relay, causing the airbag to open. The controller of our system will read the GPS location from the relay signal and communicate the information to the hospital through GSM. [11]

The goal of this research, IoT Based Vehicle Accident Detection & Rescue Information System, is to create a communication system that can be used to contact local hospitals and police stations in the event of an accident. [13].

An Observation aims to investigate and describe the primary issues and disadvantages that VANETs face, including routing protocols, security, and privacy. VANETs (Vehicular Ad hoc Networks) is a constantly used technique in the automotive industry for increasing the speed of communication between automobiles and roadside devices (RSUs). VANETs are a type of self-organizing network that falls under the category of Mobile Ad hoc Networks (MANETs). To prepare for the upcoming wireless technology era, this study will analyze the value of IoT-based VANET in traffic management systems [14].

Smart Car: An IoT-based Accident Detection System, in which a signal from an accelerometer and a GPS sensor is automatically sent to the cloud, where it is received by whoever has subscribed to the car as an alert message. The signal will identify the severity of the collision as well as the GPS location. Then, in order to get to the scene as soon as possible, an ambulance will use the Gps location [16].

This proposed system, the IoT-based Smart Accident Detection & Insurance Claiming System, will identify an accident using a vibration sensor. GPS will be used to determine where you are. The Raspberry Pi sends SMS to a member of the vehicle owner's family through GSM. The cloud server then looks up the contact information for the nearest hospital and police station in the database and informs them of the accident [17].

Accident Preventing and Reporting System based on IoT, the introducing system will manage the vehicle's speed and alert the appropriate individuals in the event of an accident. The distance sensor will also be used in those proposed ways to assess the distance between the vehicle and the obstacles every second. If the information is accurate, an email will be sent to the driver in the event of a collision. [19].

The main goal of this paper is to detect over-speeding vehicles based on a speed on a speed limit and alert the appropriate individuals using an IoT-based framework. A GPS module, radar, Google maps, and an IoT module are all part of the system. GPS and IoT technology are used to automatically control the safe zones. The battery performance of this activity tracking gadget is between 5 and 10 hours, and the sensor is developed to decrease high accident death rates. It is driven by 12 V lithium batteries and has a GPS sensing network and IoT application; the battery performance of this device is between 5 and 10 hours, and the sensor's purpose is to effectively reduce accident death rates [20].

The IoT-based vehicle anti-collision and pollution control system described in this study aims to avoid accidents and decrease pollution levels. This system analyses the ppm level of emitted gases and displays it when the vehicle is not rolling, and the level of pollution exceeds the threshold value and also notifies the user when the pollution level exceeds the threshold value. To some extent, it can also avoid collisions. Within a specific range, this technology detects a nearby obstacle and alerts the user by presenting the obstacle's direction. [22].

A survey on techniques for collision prevention in VANET focused on alternative approaches to collision prevention in vehicular ad-hoc networks (VANET) in this research, as well as possible remedies to concerns they observed. During any emergency situation, the proposed system receives vehicle and traffic information. It sent warning messages to other vehicles, allowing them to use autonomous braking to avoid collisions. Before vehicles in the network reach the accident location, the system sends an emergency alert to them [24].

This study offers a prototype of a smart Black Box System that may be placed into vehicles; based on IoT based Vehicle Accident Analysis, the system attempts to perform accident analysis by objectively tracking what happens within vehicles, as well as improving security by preventing tampering with the Black Box data [28].

Vehicle Accident Alert and Locator (VAAL), the author suggests that may identify accidents and connect with nearby organizations such as hospitals and fire services. The GPS/GSM module is equipped with an accident detector that sends a report to a GSM (message) communication platform automatically. The author mentions a system that is utilized by the EC (European Commission), and it works by automatically calling 112, which is an emergency call service, when an accident occurs [33].

Automatic Road Accident Detection Techniques: A Brief Survey, the paper compares several types of systems such as smartphones, mobile applications, VANETs, and GSM/GPS modules. The author also proposed a low-cost ultrasonic sensor-based automatic road accident detection technology in this paper. The ultrasonic sensor detects an accident and communicates the information to the proper emergency authorities [38]

Survey on Vehicle Collision Prediction in VANET, the goal of this paper is to employ VANET technology to predict and prevent collisions utilizing inter-vehicular communication. A collision can be detected using a mathematical technique that determines trajectory prediction. Furthermore, we shall learn several collision-avoidance prediction methods in this work. [39]

IoT-based car accident detection and notification algorithms for general road accidents, the researchers developed a system that allows hospitals and other medical platforms to receive real-time updates about nearby accidents. This is an IoT-based platform designed to track accidents and provide emergency medical aid as quickly as possible. This all depends on how rapidly they react, which might be a matter of life and death [44].

IRJET- IoT Based Vehicle Accident Prevention Using Multiple Sensors, the goal of this system is to prevent accidents by utilizing several types of sensors. The sensors utilized in this research are an ultrasonic sensor, a MEMS sensor, and a temperature sensor. This proposal helps with safe driving by displaying an alarm and an LCD display if the driver is inattentive while driving. In the event of a collision, it facilitates in the tracking of the location, and an image of the area is provided to the concerned person and their family's smartphone. The project's output can be used in three ways. The first is to secure and manage the vehicle against accidents caused by drowsiness. The next stage is to find the accident scene, which will help with tracking and rescue. The third point is to alert you to the fact that your engine is overheating [45].

In Speed and Distance-Based Vehicle Collision Prevention Using Electrical Effect, the author proposes a system that involves two separate modules: automated braking and electromagnetic repulsion. This module is placed in all vehicles to reduce automobile collisions. The two modules were included to improve the reliability of the anti-collision system [46].

Monitoring of Traffic at Night a Robust Framework for Multi-Vehicle Detection, Classification, and Tracking demonstrates how to convert headlamp couples into images of a single vehicle to evaluate other vehicle features such as with the screen or vehicle look. This is a two-stage system to detect with a tracking module that can handle partial and complete objects—the occlusion reasoning technique takes stakes advantage of the headlamp positions as well as the basic traffic scene layout. For scalability and to avoid application-specific cameras, the system's characteristics are generic, so there's no need to change camera settings like low exposure. [53]

Distance Sensing with Ultrasonic Sensor and Arduino, in order to detect distance, ultrasonic sensors are widely utilized. They are affordable and have reliability of less than 1 centimeter when measuring distances up to 6 meters. However, the time of flight (ToF) measurement is by far the most common approach employed in these measurements. The time spent between the emission of an Ultrasonic wave train traveling at the speed of sound and its ultimate arrival after reflection is measured in this ToF. For a single measurement, this results in long response times. Ultrasonic sensors are frequently used to measure distance. When measuring distances up to 6 meters, they are economical and also have an accuracy of less than 1 centimeter [1, 4]. However, the time of flight (ToF) measurement is the most common approach employed in these measurements. The time spent between the emission of an Ultrasonic pulse train traveling at the speed of sound and its subsequent arrival after reflection is measured in this ToF. For a single measurement, this results in long response times [55].

Measurement of Distance The outcomes of testing with a near ultrasonic system of measurement (built of Polaroid 600 sensors and a Sonar Ranging Module SN28827), which is included in sensory modules in many mobile robots, are provided in this study with a Long-Range Ultrasonic Sensor System. The lengths of the experiments vary from 0.4 to 11 meters. The evaluation of the collected monitoring results set the groundwork for selecting a distance estimator that would produce the minimum measurement errors across the entire measuring range of the system. The study was conducted in a confined room under a steady environmental temperature to avoid the influence of extraneous influences on the measurement outcome. Each measurement series contained 100 measurements [56].

IoT Based SMART Helmet for Accident Detection, the main goal of this smart helmet is to keep the rider safe. Additional features such as alcohol detection, accident identification, location monitoring, use as a hands-free device, solar-powered, and fall detection are introduced. This creates not only a smart helmet but also a smart bike feature. The idea aims to ensure the safety and security of bikers on the road. It can be used to make and receive phone calls while driving. Fall detection is a unique feature of the project; if the bike user falls off the bike, it will automatically send a message [60].

An Arduino board, ultra-Sonic sensor, temperature sensor, accelerometer, GPS (Global Positioning System) module, and GSM (Global System for Mobile Communication) subsystem help compensate the IRJET- Vehicle Accident Detection, Prevention, and Tracking System, an Internet of Things (IoT) system. When an accident occurs, a GPS module locates the scene and sends an alert message to the registered mobile phones. This alert will support the victim's immediate help. The proposed method has been found to be extremely valuable in terms of detecting the accident state and providing immediate rescue to the injured person. [66].

This study evaluates the basic potential developing from the beginning of the revolutionary notion of IoT and VANET based Accident Detection and Tracking System for the Emergency Rescue Teams in a Smart City. Two approaches that propose to prioritize emergency vehicles are the Internet of Things (IoT) and vehicular ad hoc networks. The proposed technology aids in the early detection of an accident and the immediate delivery of medical care. The proposed strategy lowers the barriers to medical support for patients. [68].

Accident detection Alert and tracking system based on IoT, this paper provides a warning before a dangerous scenario occurs and quickly provides the location. When the driver is not in a fit state to drive, an alert will be sent. Drivers should also be alerted whenever a high-risk condition is detected, as this may aid in vehicle management and crash avoidance. When an accident occurs, GPS tracks the location and uses GSM to deliver notifications. Apart from that, the proposed approach is linked to an alcohol sensor, which identifies and stops the engine when a driver is alcoholic. That is, if the driver is found to be alcoholic, the vehicle will not start [76].

2.2 Study of two most relevant papers

The next part is being described as reasons why our system is better than other systems. Two systems from the upper portion are being picked randomly for the downscale descriptions.

In paper [13], the authors create a GSM/GPRS/GPS-based car accident detection and rescue information system. It was developing a web service that alerts the owner of the vehicle, the nearest police station, as well as the hospital about the incident and its address. The author concentrated solely on the tracking and rescue aspects, ignoring the alarm component, which is as crucial in preventing a collision. The primary difference between motivation and systems is that they design a system that works after an individual has died, but our system not only performs functions after a collision occurs but also provides an alarm even before the accident occurs. The goal of this project is to create an IoT-based vehicle accident detection and rescue information system that can detect vehicle accidents and relay location information to the vehicle owner, nearby hospital, and police station via a web service. The GSM/GPRS shield is used to establish a connection between the web server and the hardware device, while the GPS shield is used to track the location. Vibration sensors, a keypad, and a buzzer detect the accident. Now, there are some places where our proposed approach is more efficient and beneficial than the existing system. For example, our system first alerts the driver if it detects a possible collision with the help of an ultrasonic sensor and continues to give a series of potential alerts to the driver with the help of LEDs and a buzzer until the collision occurs, and second, it detects any disproportion and then gives an alert to the driver, with the driver having the option of pressing a push-button in both alerts. Our system also has the unique capability of sending collision data to the insurance company for every improvement, which is quite uncommon in any system. Finally, the investigation of V2V communication ensures the highest level of driving safety in every situation.

In paper [33], our proposed solution is advantageous and appropriate in select specific sectors. The authors of this research suggested a framework that may detect accidents following a collision, monitor their location using GPS, and send alarm messages to nearby agencies such as police stations, hospitals, and fire brigades using a GSM module. Our proposed system, on the other hand, provides a method in which the driver is informed before a collision happens using an ultrasonic sensor that measures distance. To alert the driver, four separate LEDs are used, as well as v2v communication with the car. Most importantly, it notifies family members, as well as the police station, hospital, and insurance company. Furthermore, the author wants to explain the vehicle accident detection and rescue system solely. Our proposed system, on the other hand, includes the entire alerting, preventive, and detection processes as well as emergency services and the evaluation of vehicle disproportion.

Chapter 3: Factors involved in a collision

3.1 General contents of factors a collision can have

The essential components that go into calculating the probability of a vehicle collision are discussed in this section [10]. The factors such as

A. Vehicle Information: Vehicle data includes the vehicle's speed, acceleration, heading, and position in terms of latitude and longitude. V2V communication or V2R communication can be used to retrieve this data.
B. Trajectory Prediction: With the use of vehicle information, the driver's entire conceivable conduct is computed. Mathematical formulas are used to determine the trajectory. The mathematical calculations differ depending on the scenario.
C. Collision Probability Calculation: The probability of a collision is estimated by taking into account a threshold value that is selected by the user.
D. Alert Messages: Depending on the situation recognized by the system, alert messages will be broadcast, multicast, or unicast. The system should have the ability to reliably transfer messages.

3.2 Prediction flow chart

The following diagram can showcase a general overview of vehicle collision prediction.

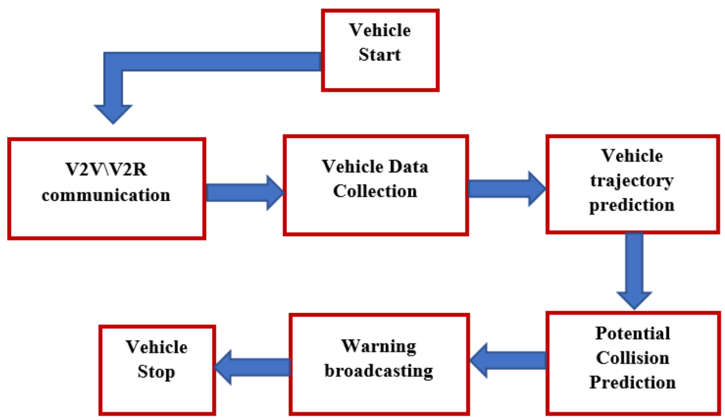


Figure 4: vehicle collision prediction diagram.

Chapter 4: Proposed method

As a third-world country, tragic circumstances such as death from vehicle collisions occur frequently. Vehicle collisions are less prevalent in developed countries, and one of the primary reasons for this is population density. We must be concerned about any sort of vehicle collisions because our country is overcrowded and has no plans to lower its population in the near future. The concern is especially concerning foggy weather and a lack of light at night according to the statistics of our country. As a result, we'd like to develop a system that alerts people when a scenario is potentially harmful and quickly shares that area in the event of an accident. In order to achieve this goal, we created a VANET based IoT vehicle accident detection and rescue data platform that uses GPS and GSM to recognize vehicle wrecks and communicate location data to vehicle owners, adjacent emergency hospitals, police stations, and an alert message is sent to the registered family members. On the other hand, VTS (Vehicle Tracking System) performs the same functions as radar, such as nearest rescue platforms checks and vehicle tracking, and as a result, certain VTS can identify accidents. Unlike most other systems, this proposal also discusses the concept of reporting collisions to the insurance company's headquarters in order to acquire a report of all documents linked with that specific vehicle. Police officers have a tough time identifying culprits because people can flee the scene of a life-threatening accident.

4.1 IoT (Internet of Things)

The Internet of Things (IoT) connects hardware, programming, sensors, controllers, and system availability to enable physical devices, automobiles, structures, and other items to collect and exchange data. The Internet of Things (IoT) allows items to be detected or controlled remotely using existing system infrastructure, facilitating the integration of the physical world into computer-based systems, resulting in increased efficiency, reliability, and cost savings, as well as reduced human intervention. The Internet of Things is the only method to connect the physical and digital worlds (IoT).[13]

4.1.1 Field of area IoT is possible to execute

i. 5G: 5G is the next generation of mobile wireless technology, and it is expected to deliver greater speeds, reduced latency, and more dependable communication to devices, enabling a slew of new IoT applications.

ii. Electrical grid industry: IoT domains are among the most important business sectors worldwide and are expected to continue rising fast in the next years. IoT architecture has already been considered for the future management of electrical power distribution to BEVs [Battery-Powered Electric Vehicles] / PHEVs [Plug-in Hybrid Electric Vehicles], and also for the management of electrical energy that can be "injected" back into the national grid via these vehicles, a technology known as vehicle-to-grid ("V2G"). In other words, the aim is that future advancements in IoT technology would enable the national grid to regulate energy generation more effectively.

iii. Autonomous/Driverless Vehicle Technology: Autonomous vehicles necessitate a massive amount of data collection and processing. When upgrading algorithms based on data interchange, driverless automobiles require connectivity (as provided by the IoTs infrastructure). For instance, driverless cars may communicate in real-time about their journey speeds, traffic information or road closures, weather updates, and impending impediments. Most of this data is exchanged across IoT-connected cars and wirelessly uploaded to a cloud system for analysis and application in order to improve automation. As a result, this subject is inextricably linked to the rollout of 5G, which will enable wireless connections with the necessary capacity for such huge data exchanges.

iv. "Smart Cities" IoT: The term "smart cities" refers to the collection and analysis of information via IoT devices, including interconnected devices, lights, and meters. Cities then use this information to improve infrastructures, utility services and other areas of city life.

v. Health care: In the hospital, the IoT is often used to improve patient safety and/or performance improvements, enabling medical practitioners to collaborate across disciplinary boundaries to provide tailored patient care.

4.1.2 Layers of IoT

Every project or research utilizing IoT requires an understanding of IoT architecture. The architecture of the Internet of Things is separated into four layers. The four layers are the interface layer, service layer, networking layer, and sensing layer.[13]

Interface Layer	The interface layer is the Internet of Things' first layer. This layer is responsible for the user-program interaction mechanisms. This section looks at how users can make the most of the system.
Service layer	This layer is where users' demands are met by creating and managing services. It achieves this by undertaking deep data processing. To make the program more user-friendly, it includes a database containing various data and gadgets.
Networking or Communication Layer	The networking layer, also known as the communication layer, ensures that the devices are linked together. There are several options for communicating between devices and the cloud. The three most well-known protocols are HTTP/HTTPS (and RESTful methods on those), MQTT 3.1/3.1.1, and Constrained application protocol (CoAP).
Sensing Layer	Sensors gather data from the environment or the object being

	analyzed and turn it into valuable information. This layer contains it all from commercial historical systems to robotic camera systems, water-level detectors, air quality sensors, accelerometers, and heart rate monitors, among many other things. The IoT is growing rapidly, thanks to low-power wireless sensing technologies and Power over Ethernet, which allows devices on a hardwired LAN to run without an AC power supply.

Table 2: Layers of IoT [13]

4.1.3 V2X communication

The collision avoidance system employs V2X communication. The three types of V2X communication are vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I). The vehicle can communicate with the other vehicles, infrastructure, and people using this communication system. [6]

4.1.4 IOT usage graph

According to the statistics [reference number] website, by 2020, The total number of smart devices connected together is estimated to reach 35 billion by 2020. According to a Siemens study, there will be roughly 26 billion physical things connected to the internet by 2020.

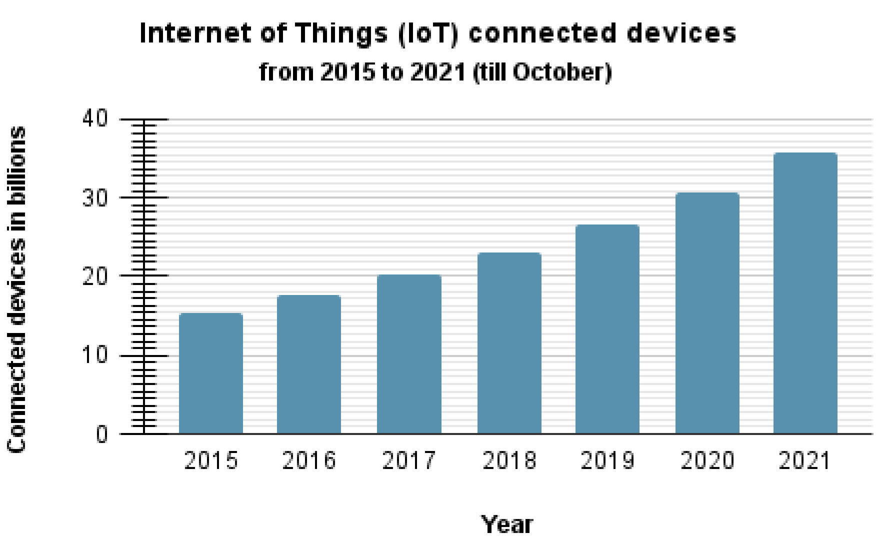


Figure 5: Internet of Things (IoT) connected devices from 2015 to 2021 (in billions) [16]

4.2 VANET (Vehicular ad hoc networks)

VANET is an acronym for "vehicular ad-hoc network." It increases both the comfort and the safety of driving—it c. The scope of the VANET application has grown as a result of recent technology breakthroughs and the emergence of smart cities around the world. VANET is a self-aware technology that aids in the improvement of traffic services and the reduction of road accidents. Because the information given by this system is time-sensitive, it is essential that dependable and fast network connections be established [13]. Although VANET, as a wireless ad hoc network, flawlessly achieves this purpose, it is subject to security concerns. Attackers are attracted to this network because of its extremely dynamic connections, sensitive data sharing, and timing sensitivity [13]. Approximately 80% of accidents lead to the demise of multiple people. Road accidents adversely impact developing countries on a regular schedule. The main reasons are inadequate infrastructure, traffic control, and accident management. Because spontaneous networking is the main concern of VANET, facilities such as RSUs or cellular networks are less of a problem.

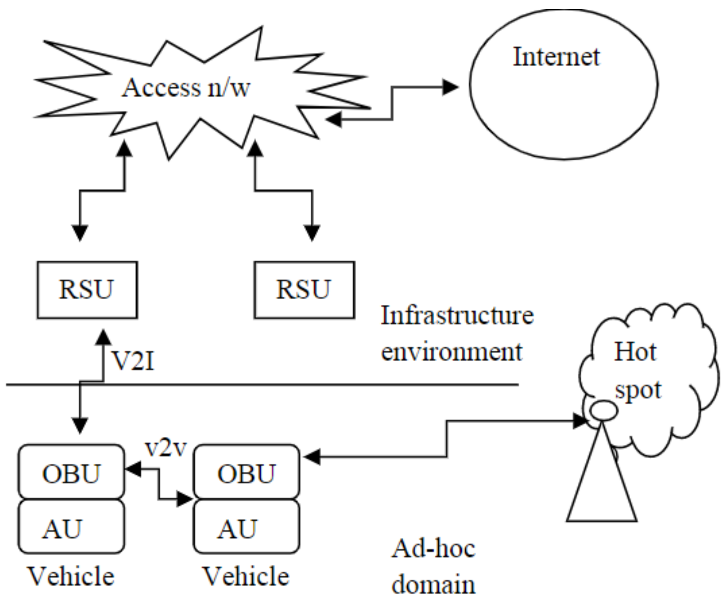


Figure 6: Architecture of VANET [14]

4.2.1 Application of VANET:

The applications of VANET have now spread in a number of categories where the main motive is to ensure safety in different circumstances. These are some of the VANETs applications.

1. Vehicle collision warning

2. Security distance warning
3. Driver assistance
4. Cooperative driving
5. Cooperative cruise control
6. Internet access
7. Map location
8. Automatic parking
9. Driverless vehicle

4.2.2 Fields of VANET

Though our motive is to reduce collisions, there has been a significant number of fields of VANETs which have taken wireless technology into the modern era. Some of the fields of VANET are:

1. Intersection collision warning
2. Lane change assistance
3. Road map
4. Accident detection and alerting
5. Traffic planning
6. Overtaking vehicle warning
7. Emergency vehicle warning
8. Point of interest (PoI) allocation
9. Weather information

4.2.3 VANET challenges:

Past study has largely noted the potential of increasing the number of attached devices in the system, energy utilization, unstable traffic flow, geographic conditions, unexpected network connectivity, and transmission storm. [8]

Some of VANET's main Challenging issues are given below [14]:

1. VANET disseminates sensitive data, attracting a wide range of opponents.
2. The WAVE standard does not include any authentication or association protocols because of the need for quick network deployment.
3. The model is easier to attack because of a lack of infrastructure.
4. There's a good chance your privacy will be compromised.
5. Connection infiltration is relatively simple due to the continually changing topology.

4.2.4 VANET routing approaches & protocols

Routing techniques are required for scalability. The process of transporting packets from one network to another is known as routing. Wireless-based technologies are used by the VANET to connect between apps and services. It also has a high dynamic topology and the ability to support irregular connectivity, among other things. The early VANET, on the other hand, lacked routing algorithms, which caused network communication problems. In existing VANETs, three types of routing protocols are used: broadcast, geocast, and unicast. The current VANET routing protocols are listed below [8]:

Routing approaches	Routing protocols
Unicast	Ad hoc On-Demand Distance Vector (AODV) General Packet Radio Services (GPRS) Vehicle-assisted data delivery (VADD) Dynamic Source Routing (DSR) A-START Position-based multi-hop broadcast (PMB) Improved greedy traffic-aware routing (GyTAR) Trajectory-based data forwarding (TBD) Connectivity Aware Routing (CAR) Geographical Source Routing (GSR) Opportunistic packet relaying in disconnected vehicular ad hoc networks (OPERA) MaxPreps SiFT Trajectory-based data forwarding (TBD)
Broadcast	Linkage Protocol for Highway automation (DOLPHIN) BROADcast COMMunication protocol (BROADCOM) Distributed vehicular broadcast (DV-CAST) Packet routing algorithm
Geocast	Distributed robust geocast protocol (DRG) Robust vehicular routing (ROVER)

Table 3: Routing approaches & protocols [8]

4.3 VTS (Vehicle Tracking System)

Bangladesh has access to this VTS. Vehicle Tracking System (VTS) is provided by a number of companies, including GP and ROBI, and provides some standard services such as vehicle tracking via satellite GPS and GSM connection. Therefore, no system is available that can both identify as well as provide VTS. Each VTS fulfills the same functions, including speed checks and traffic monitoring. Accident detection can be done with some VTS. In the event of an accident, however, there is no VTS that notifies the nearest hospital and police station. This system measures distance and tracks imbalance situations by different sensors, which give us distance alerts. By using V2V communication, the drivers could be aware of any kind of dangerous incidents. If there is an accident, it can notify with GPS and GSM and automatically send alert messages to registered numbers. Servers search nearby hospitals, police stations, and insurance company phone numbers from the database and notify them for urgent help to reduce instant loss or damage.

4.4 System architecture

4.4.1 List of component and technology

Based on a thorough evaluation of the papers and a step-by-step review of the results, the components and technologies were chosen:

1. Ultrasonic Sensor
2. Vibration Sensor/ Accelerometer
3. LED
4. Buzzer.
5. GPS
6. GSM
7. Push Button
8. Wi-Fi Module
9. Cloud Server
10. Arduino

4.4.2 Description of components and technologies

1. Ultrasonic sensor: It's a digital device that detects the range of a specific item via ultrasonic sound waves and then changes the displayed sound into an electrical signal. Two ultrasonic sensors are used to detect collisions. These two are located on the vehicle's roof, on the front and back sides, respectively. We'll need two threshold distances as a result of this. The front roof to the front bumper is one, while the back roof to the driver's side is the other. The distance between any two points is always greater than the threshold. When a vehicle comes within a preset threshold distance, the device activates and uses the GPS module to determine our vehicle's location. An ultrasonic sensor costs only $0.65, making it a very cost-effective instrument.

2. **GPS:** The GPS (global positioning system) is a satellite network for locating cars and people. Employer monitoring, traffic and weather notifications, and so forth are examples of other applications. Most importantly, GPS is easy to use and can be found practically everywhere for a fair price.
3. **GSM:** GSM stands for Global System for Mobile Communication, and it is used to send messages from anywhere in the world to manage and monitor the transformer load.
4. **Buzzers:** An auditory signaling device that makes a buzzing sound, sometimes known as a beeper. When a driver falls asleep or is in danger, buzzers will sound, alerting the driver to the danger.
5. **LED:** When an electric current runs through a light-emitting diode (LED), it emits light. We used three LEDs, one for each of the four colors: red, green, yellow, and blue.
6. **Arduino:** The Arduino platform is a free-to-use open-source electronics platform. Arduino boards can read light from sensors and turn on LEDs, among other things. By giving the board's microcontroller a set of instructions, you may tell it what to do.
7. **Vibration Sensor:** A vibration sensor detects the magnitude and frequency of vibration in a system. These metrics can be used to determine if any imbalances or other issues exist.
8. **WIFI-Module:** Wi-Fi modules are electrical components that enable a wireless internet connection in a variety of applications. The term WLAN refers to a wireless local area network.
9. **Cloud Server:** A virtual server that runs in a cloud computing environment is known as a cloud server. Cloud servers are well-known for their ability to store and process data.
10. **Push Button:** Push-button is a simple switch mechanism used to control a machine or process. In our system. Push-button is attached to the microcontroller.

4.4.3 Graphical architecture based on requirement tool

The downscaled figure introduces the overall architecture of the system:

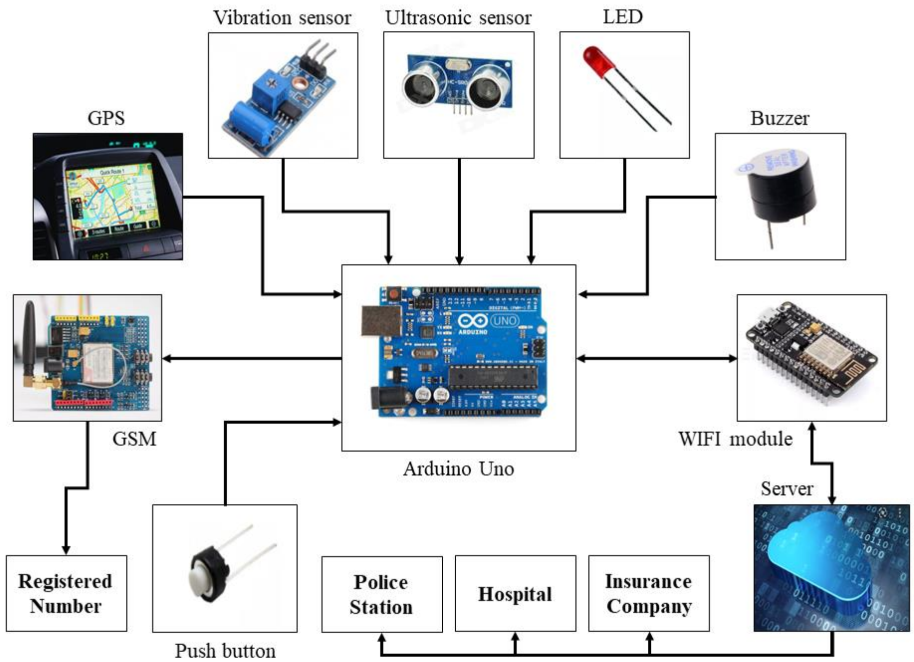


Figure 7: Graphical architecture

4.4.4 Description of the connections of the architecture

We propose an IoT-based accident detection and prevention system in order to address the shortage of readily available standard datasets for collision detection and prevention. Figure 4.3 displays the system architecture. Most automobiles now have built-in GPS systems to aid passengers while driving.

The GPS is connected to the Arduino Uno in our system. The vehicle's location can be easily identified because GPS is utilized to locate automobiles and individuals. Following an accident, GPS will track the vehicle's location so that emergency personnel can arrive quickly.

The vibration sensor and the ultrasonic sensor are both active at the same time in this situation. Through the use of ultrasonic sound waves, an ultrasonic sensor is used to estimate the distance between vehicles. The ultrasonic sensor in our system is linked to an Arduino Uno microcontroller. It is used to notify drivers of their vehicle's location, and the system will notify them via red, green, yellow, and blue LEDs and the red LED alert accompanied by a buzzer sound. The point to be noted is that the LEDs are connected with the microcontroller. Through vehicle-to-vehicle communication, an alert message will be delivered to all vehicles within a certain range.

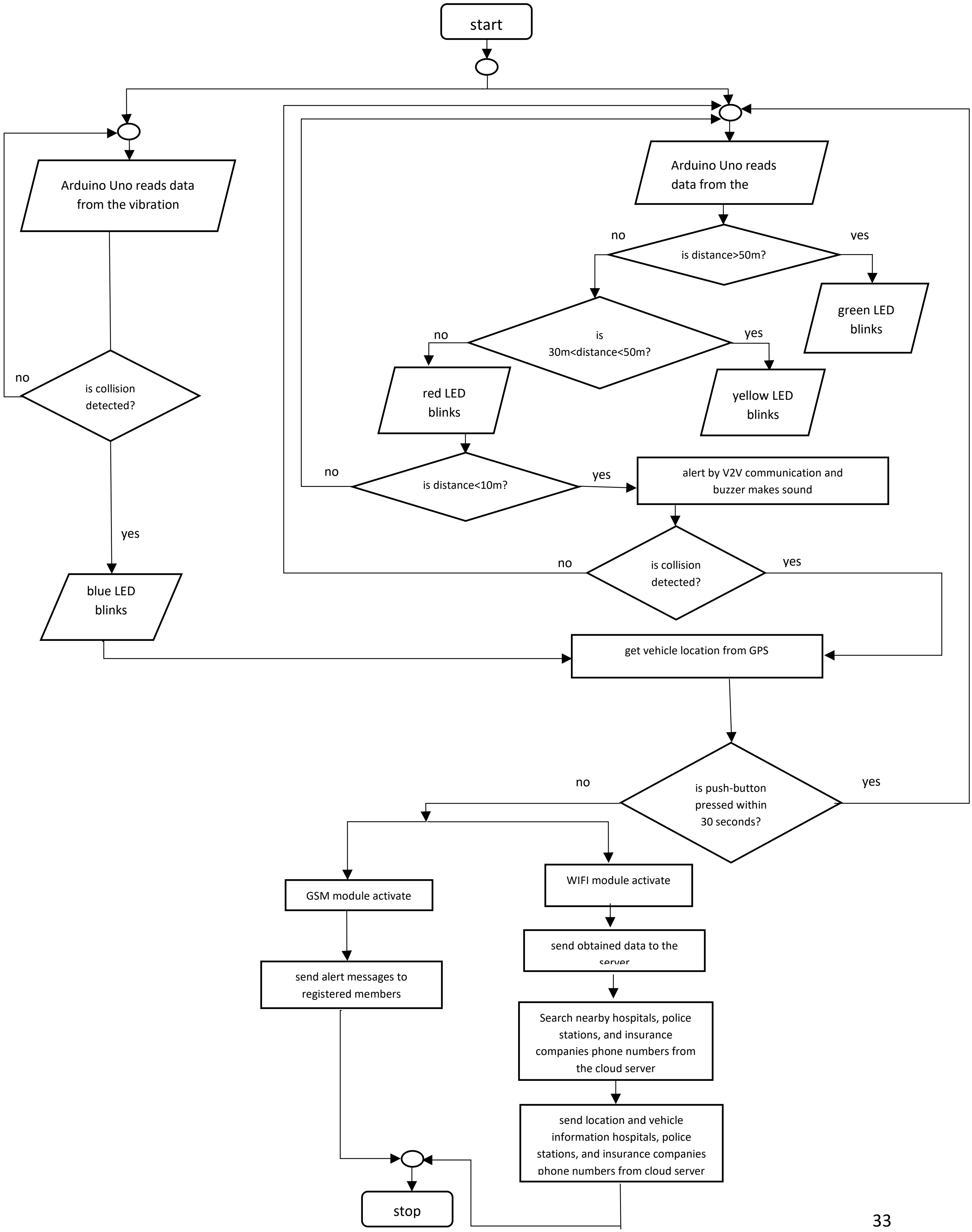
The vibration sensor is used to detect the unbalanced situation and is connected to the Arduino Uno. When the vibration value exceeds the threshold limit, the vibration sensor detects a mishap and alerts the Arduino-Uno. The Arduino-Uno is controlled by a single push button switch. If the button is pressed within 30 seconds, the system considers the driver to be safe and does not advance to the following phase. However, if it is not pressed within that period, the system will advance to the next phase because the driver is not in excellent shape.

The data is subsequently sent via the processor's Wi-Fi module to the cloud server. The microcontroller is linked to the Wi-Fi module in our suggested system. Furthermore, the Wi-Fi module is connected to the cloud server.

Simultaneously, the system sends SMS to the registered number using the GSM module. The Arduino-Uno is connected to the GSM module in our system. The cloud server scans the database for phone numbers for the nearest hospitals, police stations, and insurance companies, as well as any new accident information. As a result, the hospital will dispatch an ambulance to the accident scene, along with a police officer to document the crime scene. The circumstances of the collisions will also be given to the insurance companies so that a representative can attend on the spot and speed the insurance claim procedure.

4.5 Flow chart

In this segment, a flowchart encompassing all of the specifications and work instructions is demonstrated. Some functions respond differently when it comes of the system's responses, and those functions are defined accordingly.


start
Arduino Uno reads data from the vibration
is collision detected?
no
yes
blue LED blinks
Arduino Uno reads data from the
is distance>50m?
no
yes
green LED blinks
is 30m<distance<50m?
no
yes
red LED blinks
yellow LED blinks
is distance<10m?
no
yes
alert by V2V communication and buzzer makes sound
is collision detected?
no
yes
get vehicle location from GPS
is push-button pressed within 30 seconds?
no
yes
GSM module activate
WIFI module activate
send alert messages to registered members
send obtained data to the server
Search nearby hospitals, police stations, and insurance companies phone numbers from the cloud server
send location and vehicle information hospitals, police stations, and insurance companies phone numbers from cloud server
stop

4.5.1 Procedure of flow chart

The microprocessor begins its functions as soon as the vehicle starts up. Two sensors are used in the system: an ultrasonic sensor and a vibration sensor. In such situations, both sensors have their own set of needs. In addition, both sensors will begin working at the same time and carry out their functions.

After the Arduino reads data from the ultrasonic sensor, the system will measure the distance between vehicles or obstacles around it every second. If there is no vehicle within 50 meters of the system, a green LED blinks continuously; nevertheless, if something enters that range, the system begins flashing with a yellow LED. The yellow LED will continue to flash until the distance is between 30 to 50 meters, and if the range is less than 30 meters, a red LED will begin blinking.

If a vehicle appears within 10 meters, the system sends a warning message via V2V communication with a buzzer making noise all along to confirm the probability of a collision. If this is not the case, the system will resume processing from the beginning.

Following that, if a collision occurs, the sensor will confirm the collision, and the GPS will follow the vehicle's location immediately. There is also a push-button function in the system that the driver can use. The system does not send any alarm messages if the driver presses that button. However, if the button is not pressed within a specific length of time, the system will proceed to the next step.

If the push button is not pressed, the GSM and WIFI modules are activated at the same time. The WIFI module delivers the data to the server, GSM, on the other hand, delivers the alert message together with the necessary information to the registered phone numbers. Following the transmission of the gathered data, the WIFI module looks for the phone numbers of nearby hospitals, police stations, and insurance organizations. If the server discovers any contact numbers, it transmits the collision information to that contact right away.

On the other hand, the vibration sensor checks for any disproportionate condition and, if it detects one, the system blinks a blue LED to inform the driver of the problem. If the driver presses the push button, the process begins again, but if the button is not pressed, GPS will monitor the location, and the GSM and WIFI modules will execute their functions as before.

4.5.2 Comparison Table of related work

The table showcase different types of solutions from previous related works:

Author Details & Reference Number	Title	Accident location detection	Send alert messages	Send alert based on distance measurement	Family member	Police station	Hospital	Insurance Company
K. L. Narayanan, C. R. S. Ram, M. Subramanian, R. S. Krishnan, and Y. H. Robinson [17]	IoT-based Smart Accident Detection & Insurance Claiming System.	✓			✓	✓	✓	✓
V. Matthews And E. Adetiba [33]	Vehicle Accident Alert and Locator (VAAL)	✓				✓	✓	
Amin, A. B., Patel, H. P., Vaghela, S. P., & Patel, R. R [22]	IoT Based Vehicle Anti-Collision And Pollution Control System		✓	✓				
S. Santhosh Kumar, S. Srimanikandan, G. Sriram and A. Jenifer[11]	IoT Based Smart Vehicle Monitoring System	✓			✓	✓	✓	
A. Shaik et al. [16]	Smart Car: An IoT Based Accident Detection System	✓			✓		✓	

S. Nanda, H. Joshi and S. Khairnar [19]	IoT based Accident Preventing and Reporting System	✓	✓		✓		✓	
Nagvekar, A., Betkar, S., Kute, V. and Patil [3]	SIMULATION OF ACCIDENT DETECTION SYSTEM USING VANET	✓	✓				✓	
Kaur, Manjinder; Malhotra, Jyoteesh; Kaur, Pankaj Deep [68]	VANET-IoT A based Accident Detection and Management System for the Emergency Rescue Services in a Smart City	✓	✓				✓	
Choubey, P.C.S. and Verma, R [66]	IRJET- Vehicle Accident Detection, Prevention, and Tracking System	✓		✓	✓	✓	✓	
Nandakumar A, D., Suresh, T., Aarthi, M., Gomathi, K., Aarthi, G. and Mugilan, P.[76]	Accident detection Alert and tracking system based on IoT	✓	✓		✓		✓	

Table 4: Comparison Table

4.6 Case diagram

The case diagram helps to understand the connectivity's between the actors and the actions. The following one represents the relations between the user and the system of our proposed system.

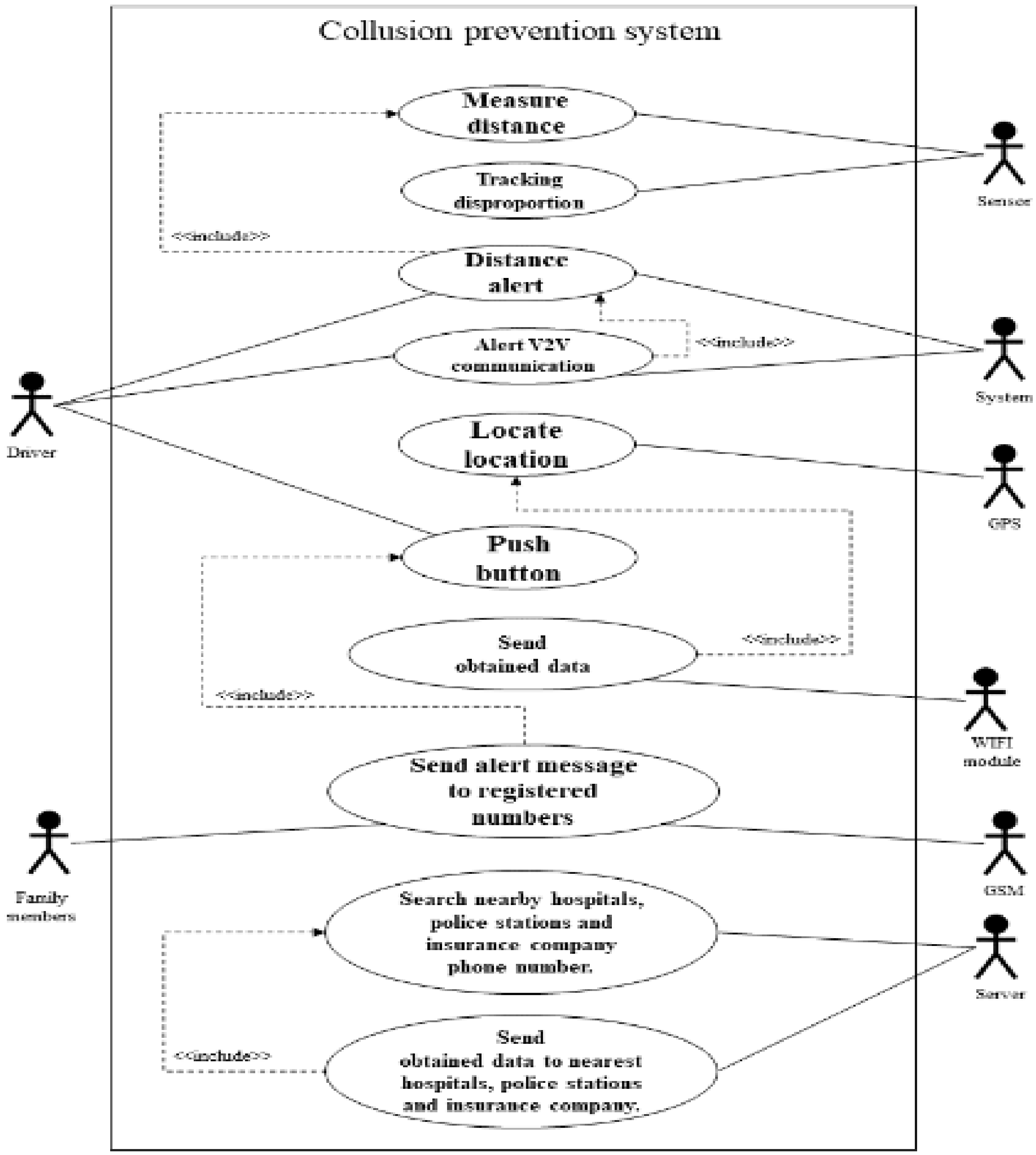


Figure 9: Case diagram

4.6.1 Table containing the contents of the case diagram

The downscaled table will showcase the functionalities of each actor and the actions of the flow chart.

Actors	Condition	Function
1. Driver	1. The vehicle owner or drive the vehicle 2. Drivers should have a driving license.	1. Distance alert 2. Alert by V2V communication 3. Push-button
2. Sensor	1. Must be installed in the system.	1. Measure the distance 2. Tracking disproportion.
3. System	1. Must be installed in the vehicle	1. Distance alert 2. Alert V2V communication
4. GPS	**1.** Must be installed in the system.	1. Locate the location
5. GSM	1. Must be installed in the system.	1. Send an alert message to registered members
6. WIFI Module	1. The system's input and output are supplied by an external system.	1. Send obtained data
7. Server	1. System required information is supplied by the Wi-Fi module.	1. Send obtained data to nearest hospitals, police stations, and insurance companies.
8. Family Member	1. The number must be registered on the server.	1. Send alert messages to registered members

Table 5 : The contents of the case diagram

4.7 Estimated cost

The cost is calculated based on the current market value in Bangladesh. Prices may fluctuate from time to time.

Components	Quantity	Estimate Price(BDT)	Estimate Price (Dollar $)
Ultrasonic sensor	2	200	2.33
Accelerometer	1	279	3.25
LED	4	16	0.19
Buzzer	1	15	0.18
Push Button switch	2	10	0.12
Arduino Uno	1	609	7.16
Wi-Fi module	1	410	4.82
GSM Module	1	403	4.74
	Total Price	1942	22.64

Table 6 : Table of the estimated cost

Chapter 5: Security of the system

The system's overall security is a critical component. Securing wireless communication between devices isn't a major concern. There are a variety of mechanisms for secure position verification, authentication, data security, obscurity, and security in ad-hoc wireless networks and the VANET itself. [26].

There are essential parts that must be secured for the tracking part. GPS must be secured from two kinds of attacks: removing or changing the facts of its memory and being unplugged or switched off from the vehicle. [26] The first assault can be solved easily by using data security prevention and fault-tolerant industrial design. Furthermore, no one can update or modify the onboard unit's internal database since there are no input ports. The traffic administration or automobile manufacturers are entirely responsible for vehicle identity connection [26]

The second attack, avoiding the GPS from just being switched off or removed, requires extra precaution. The onboard unit must be coupled to the vehicle's power system and function as a circuit breaker. If the vehicle is purposely switched off or decomposed, this will not start or run. Actually, there is a range of technologies that function in the same way for vehicles. Because the system has a GSM chip and a regular mobile number, some professional security systems to protect against car theft may be installed on any vehicle and remotely accessed by a cell phone. If the robber is successful in starting and moving the car, the system will inform the owner via his mobile phone (which was pre-programmed before the system was installed) [26]. By dialing the vehicle's number and pushing a few buttons on his phone keypad, the automobile owner can remotely halt the vehicle from anywhere in the world. The engine will then be turned off, the electricity will be turned off, and a loud siren will be triggered. If the vehicle has a GPS receiver, it can also notify the owner of the exact location of the vehicle [26].

To ensure that the onboard system is operating normally, various status-check modules must be implemented. Furthermore, the accompanying equipment must broadcast its status wirelessly on a routine basis. At a checkpoint or during a traffic patrol, a gadget to verify the state of the onboard unit must be present. The authorities will be notified if a vehicle comes too close to these 258 devices and its onboard unit is switched off or ignored, and they will respond promptly [26].

It's possible that a new issue will arise. What if a specialist removed the entire system from the vehicle and avoided the system? Applying intelligence to build the system is a simple solution. The system will remember the event even if it is removed or bypassed. Moreover, the system will emit signals that can be acquired by traffic patrol or the vehicle owner, indicating that the automobile system has been overcome. There may be other options for dealing with this situation [26].

5.1 Privacy

A significant proportion of studies in the area discovered that the most major problem associated with delivering data or messages across VANETs is security and privacy. Due to the act of online data security for private information, the kinematic data of the components of VANET cannot be disclosed to collusion between harmful servers and users. Recent developments in this subject have tackled the issues of data ownership, huge data management, and compliance regulations. [8].

Security architecture plays a critical part in assuring security and privacy in order to solve the problem. As a result, the construction of a vehicular communication system should be focused on providing a communication scheme for safety-based applications, as this will provide a shared session key for a secure network connection. Roadside attackers may submit fake requests on-road or parking cloud services, generating confusion because data clouds have a low-security threshold [8].

Fundamental limitations and opportunities in terms of theoretical approach, relevant IEEE standards, interconnection among vehicles and structures, cross-layer design, movement, validation, and cross-layer design are other concerns that have received considerable attention in VANETs research [8].

Chapter 6: Limitations

i. Animal detection: In our system, there is no animal detecting functionality. However, having these features in a system is critical since animals frequently move in the center of the road or attempt to cross it, particularly in the Bandarban and Chittagong areas, where animals frequently visit the road at night. Large animals have the potential to kill, injure, or damage humans and their property.

ii. Doesn't work in every circumstance: Vehicle design, speed of operation, road layout, weather, road conditions, driving abilities, and impairment caused by alcohol or drugs are all factors to consider., and conduct, particularly aggressive driving, distracted driving, speeding, and street racing, all contribute to the probability of crashes. Any type of traffic collision necessitates these characteristics. However, because VANET does not work in the rain, all of the above elements will not work in every situation. As a result, there is still the slightest possibility of a safety problem. However, our system is one of the options for detecting a vehicle accident when compared to the other features.

iii. Time Consuming: VANET is a self-aware technology that has a major impact on traffic service improvement and lowering road accidents. Because the information communicated in this system is time-critical, it necessitates the construction of reliable and fast network connections. VANET, as a wireless ad hoc network, fulfills this requirement perfectly; however, it is vulnerable to security assaults. This network's highly dynamic connections, sensitive information sharing, and timing sensitivity make it an appealing target for attackers.[14]

iv. Drowsy Driver Detection: Our system can't detect drowsy drivers. And also, we didn't use alcohol sensors to detect alcoholic drivers in our system. As previously said, our system would warn the driver with various blinking LEDs and buzzers based on the distance to avoid a collision. In case any driver feels asleep, then this system will help him at least a little bit from the collision.

Chapter 7: Future Work Plans

Because of the system's limitations, it will need to be modified sooner or later for a better experience. With this motive, we can add a couple more scopes to our proposed solution. The scopes can be implemented in the existing system only by adding a few more sensors and other stuff in it.

i. Animal detection: In Chittagong, tourist destinations include Bandarban, Kaptai, and a few other interesting places; animals do occasionally visit the road at night. Tree snakes, striped keelbacks, and dead water snakes were among the snakes thrown on the road by some boys. These occurrences are fairly typical during long-distance journeys in Bangladesh for various purposes. As a result, a mechanism is required to prevent any accidents as a result of this.

ii. Drunk Driver Alert System (particularly in highway bus cases): Accidents frequently occur as a result of a lack of awareness. Particularly dangerous crashes occur when truck and bus drivers are drunk late at night. A future scope can be added to the suggested system to avoid this issue. Even before an accident occurs, sensors will detect that the driver is drunk, and data will be sent to the nearest police station by GPS and GSM. In addition, a sensor to detect eye blinks and a Raspberry Pi camera to assist in image capturing can be added [34].

iii. Reckless Driving: One of the leading causes of traffic accidents has been identified as blindfold driving. In truth, the majority of accidents on our roads are caused by inexperienced drivers' hurried and careless driving. Due to a lack of traffic restrictions and the impunity enjoyed by drivers said to be a frequent practice in our country. In many ways, the two elements mentioned above, a lack of enforcement of the law and impunity, motivate irresponsible driving. Another obvious factor is the issuance of driver's licenses without following the proper procedures.

iv . Driving License: A huge majority of drivers are uninformed of the traffic rules and regulations that apply to their driver's license. If the person has a driver's license, it should be checked to see if it is valid. The RFID technique can be used to avoid this problem. The RFID reader on the car will have a maximum of 10 registered users who will be able to utilize it. As a result, this helps to ensure that the vehicle is not stolen and that the person riding it is not under the age of 18 or inexperienced [21].

Chapter 8: Discussion

The proposal has been developed with the influence of rapid and advanced technology of VANET and IoT in vehicle-related systems. Unlike other proposals, as our system can work out in different circumstances and additionally the installation of the system is very convenient and easy to understand and use, this will encourage vehicle owners and also the companies to experience the use of it. The use of two different sensors has given the result of the maximum level of driving safety. And also, the technology of V2V can introduce an upper level of technology in Bangladesh. In addition to that, the system is also very interactive as it interacts with the driver with LEDs. The latest part of VTS can also encourage a certain number of platforms to develop different fields of security, and it also takes our technology to an advanced platform. Last but not least, the system has introduced an advanced use of those components which already exist in cars in our country, for example, GPS.

Chapter 9: Conclusion

VANET and IoT are rapidly evolving technologies that have been effectively implemented in vehicle-related systems. Our proposed system has been explored with the help of advanced technology. Undeniably, our provided solution has many advantages compared to previous solutions. Based on a particular distance, two types of vehicles & objects are detected via sensors. The technology will assure the driver's safety by utilizing several types of LEDs. Additionally, the safety of nearby vehicles is being ensured through V2V communication. If a collision has occurred, then without any delay, this system provides emergency help as soon as possible. Besides, it can keep monitoring the present state of the vehicle with the help of GPS. Compared to other systems, our proposed approach consists of low cost. Despite the fact that the suggested system has been designed to be simple, easy to use, and flexible, various known problems remain.

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